



**Freysteinn Sigmundsson  
and the FUTUREVOLC team**

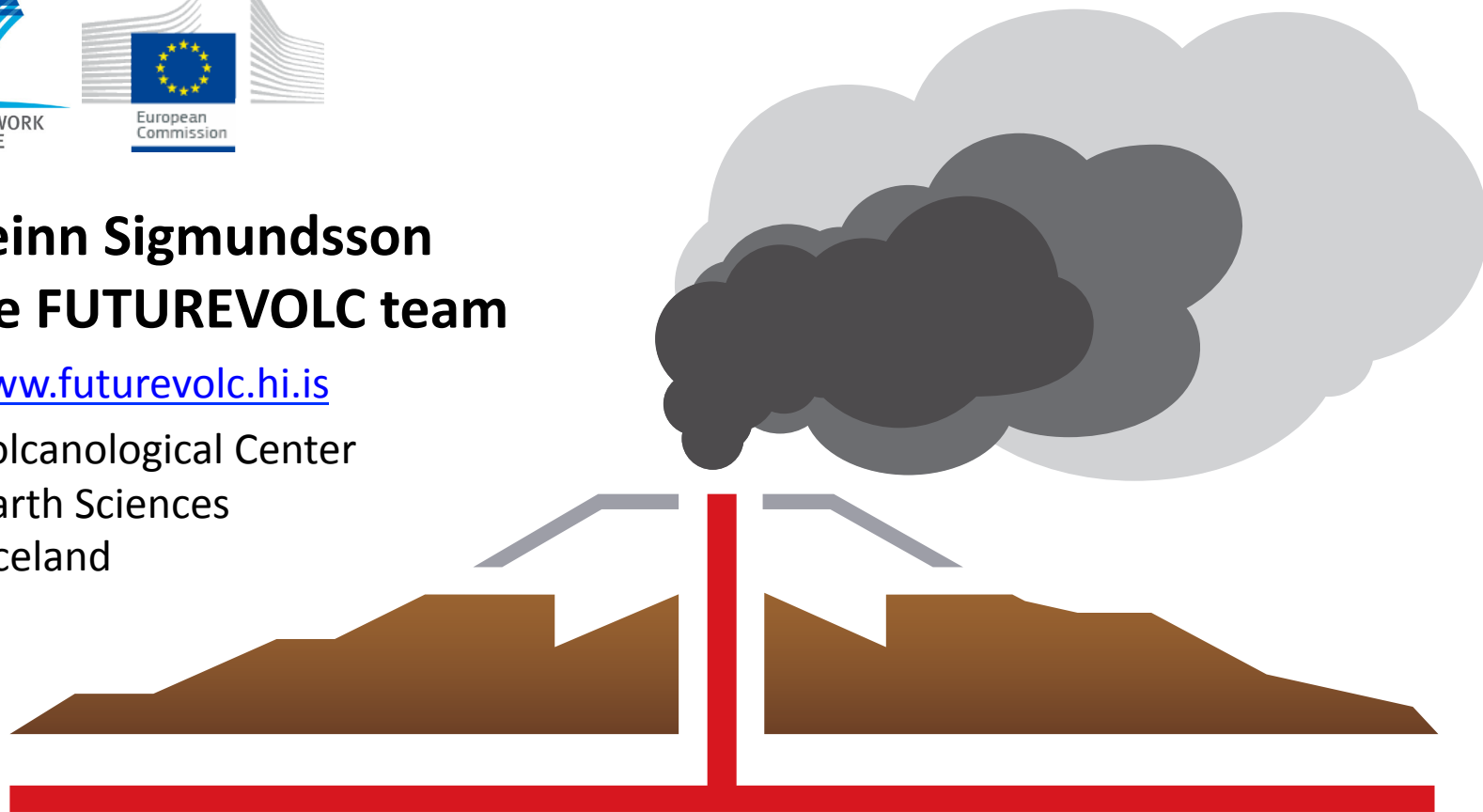
<http://www.futurevolc.hi.is>

Nordic Volcanological Center

Inst. of Earth Sciences

Univ. of Iceland

([fs@hi.is](mailto:fs@hi.is))



# FUTUREVOLC

A EUROPEAN VOLCANOLOGICAL SUPERSITE IN ICELAND:  
A MONITORING SYSTEM AND NETWORK FOR THE FUTURE



## Icelandic Participants:



UNIVERSITY OF ICELAND

Science Institute

Institute of Earth Sciences

Nordic Volcanological Center

**Icelandic Met  
Office**



Civil Protection

SME: Data base development



SME: User interface of data base



**SAMSÝN**

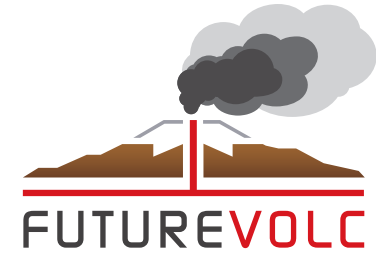


**UK:**

UK Met Office  
Univ. Cambridge  
British Geological Survey  
Univ. Bristol  
Guralp Systems (SME)  
Univ. Leeds (to join)

**Italy:**

Univ. Florence  
Univ. Palermo  
Univ. L'Aquila  
Himet (SME)  
iTEM (SME)

**Ireland:**

Univ. College Dublin

**Netherlands:**

Delft University of Technology

**Germany:**

DLR - German Aerospace Center  
GeoForschungZentrum Potsdam  
Univ. Wurzburg

**Switzerland:**

Univ. Geneva

**France:**

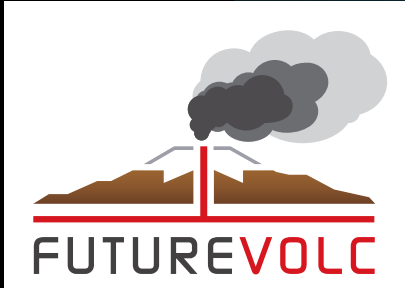
Univ. Clermont-Ferrand

**Norway:**

NILU - Norsk inst. for luftforskning  
Nicarnica Aviation (SME)

**Sweden:**

Univ. Uppsala  
Chalmers Tech. Univ.



# VOLCANIC SUPERSITE IN ICELAND

- Proposal submitted to ENV 2012.6.4-2: Long-term monitoring experiment in geologically active regions of Europe prone to natural hazards: the Supersite concept
- Coordinated with EPOS (European Plate Observing System): <http://www.epos-eu.org/>
- Study area: The volcanic zones of Iceland, with focus on the most active volcanoes (including Katla, Grímsvötn, Hekla)
- Open data policy in line with GEO / GEOSS
- Contribution: Mitigation of the effects of eruptions providing threat by long-range ash and gas transport.

Eyjafjallajökull 17 April 2010 (MODIS)

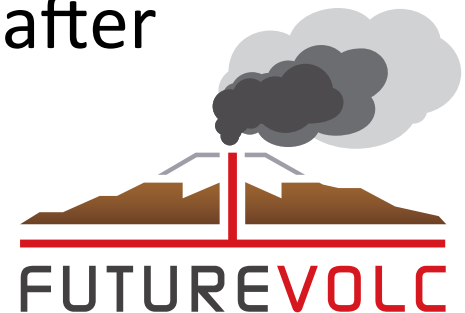


# FUTUREVOLC – connections to: Supersites, GEO, GEOSS, EC, EPOS

- **Supersites** - an initiative of the geohazard scientific community. Initiated the Group on Earth Observations (**GEO**) in 2007. The GEO Supersites provide access to spaceborne and in-situ geophysical data of selected sites prone to natural hazards.
- **GEOSS**: The Global Earth Observation System of Systems.
- **EC supersite**: Funding from EU's 7th Framework Programme.
- FUTUREVOLC will contribute to the **GEO 2012-2015 Work Plan** by providing easy access to monitoring data before, during and after eruptions which will advance scientific research, and help to empower and support all decision-makers.
- FUTUREVOLC will collaborate at an international level with other supersites directly and through **EPOS** (European Plate Observing System – European integrated research infrastructure project)

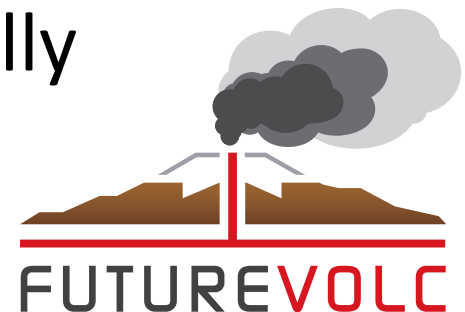
# FUTUREVOLC objectives 1 and 2

- **Establish an innovative volcano monitoring system and strategy** by integrating transdisciplinary knowledge and subject areas, thus building the bridge to achieving best practise in future volcano monitoring, early warnings, data sharing and eruption response at a European level.
- **Develop new methods and instrumentation** for near real-time integration of multi-parametric datasets for monitoring magma movements and volcano behaviour before, during and after volcanic crises.



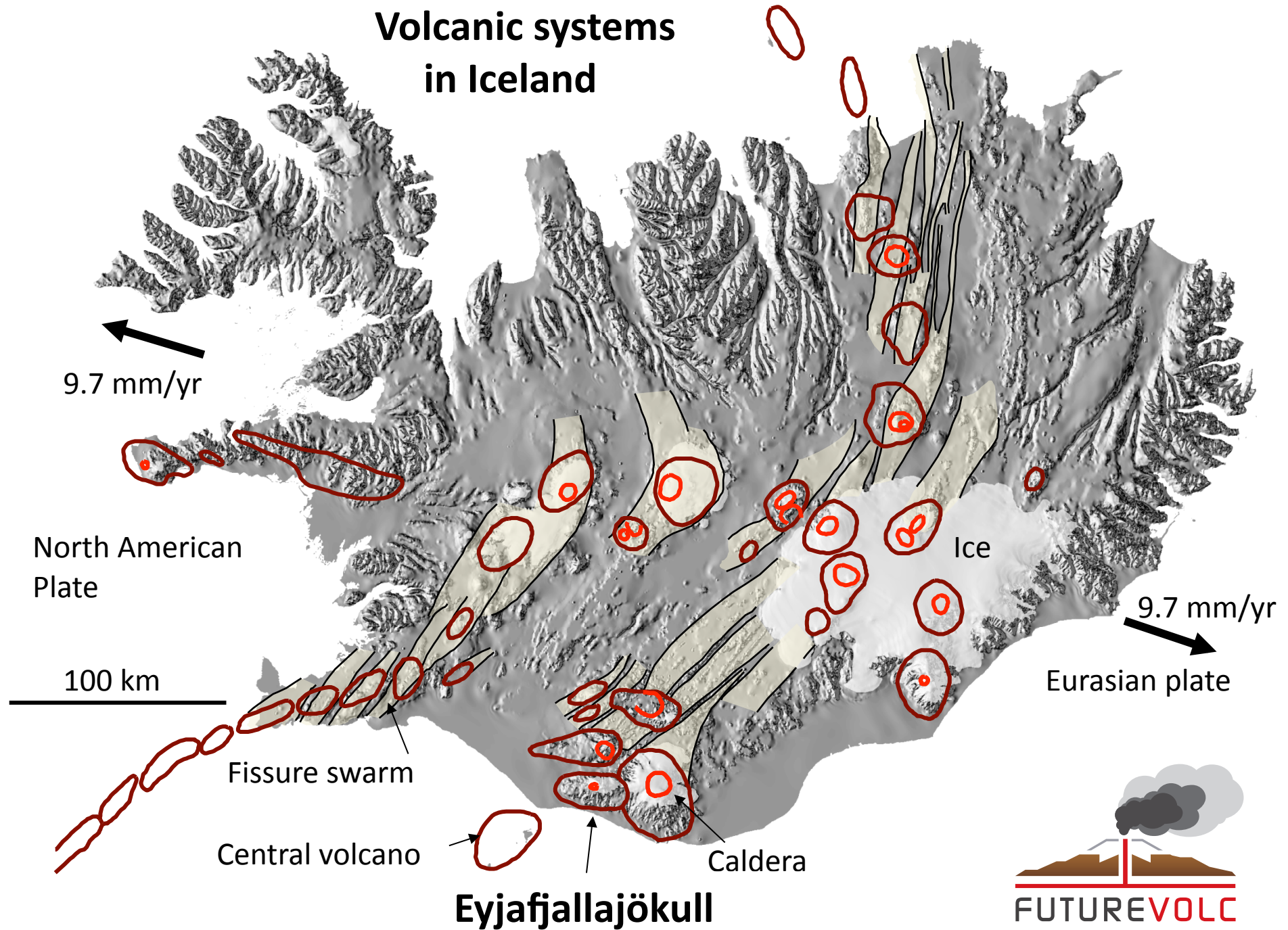
# FUTUREVOLC objectives 3 and 4

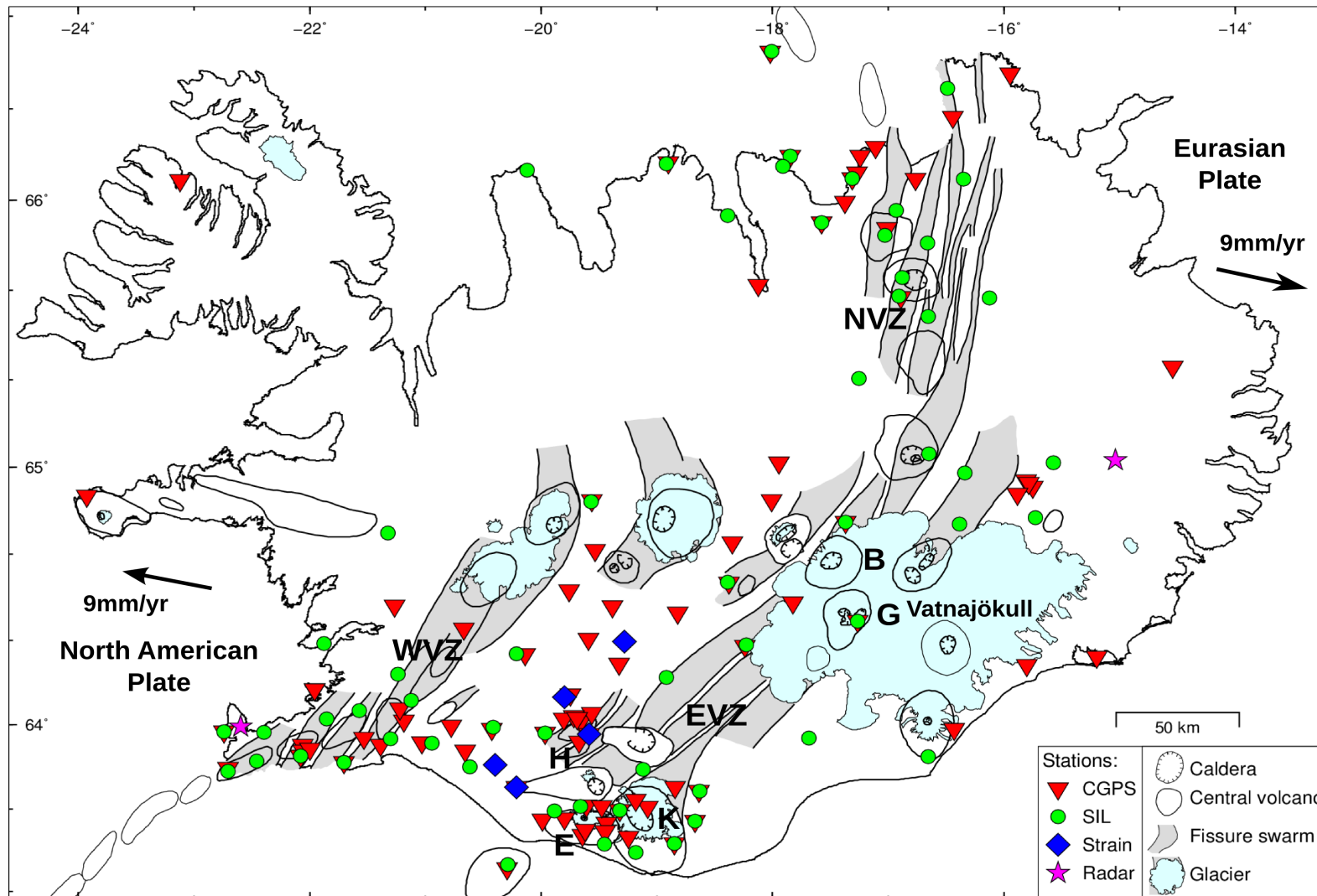
- Transdisciplinary approach to **further scientific understanding of physical processes** ranging from deep magma transport, through eruption dynamics to plume dispersion and deposition of eruptive products.
- **Improve delivery**, quality and timeliness of transdisciplinary **information** from monitoring scientists to civil protection and governing authorities, locally and internationally





# Volcanic systems in Iceland





## Iceland, volcanoes, plate boundary, present long-term monitoring stations

Volcanic zones: Western, Eastern, and Northern (WVZ, EVZ, NVZ).

Most active volcanoes are Grímsvötn (G) and Bárðarbunga (B) under the Vatnajökull ice cap, Katla (K) under Mýrdalsjökull ice cap, and Hekla (H).

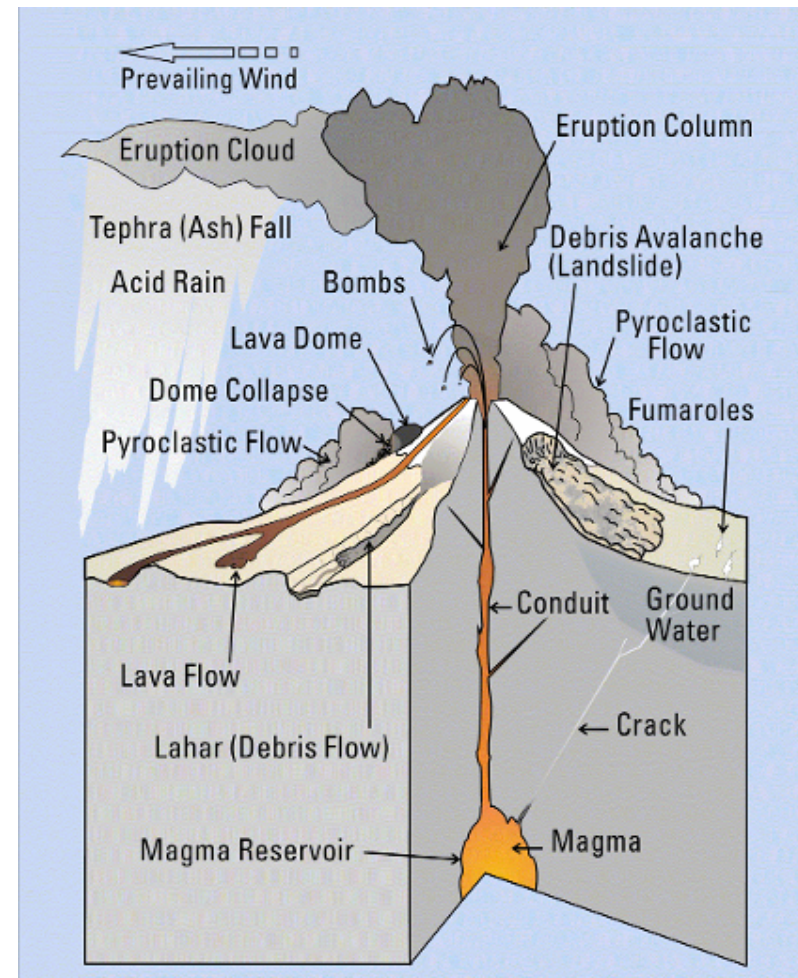
Eyjafjallajökull volcano is labelled E



# Eyjafjallajökull summit eruption 2010



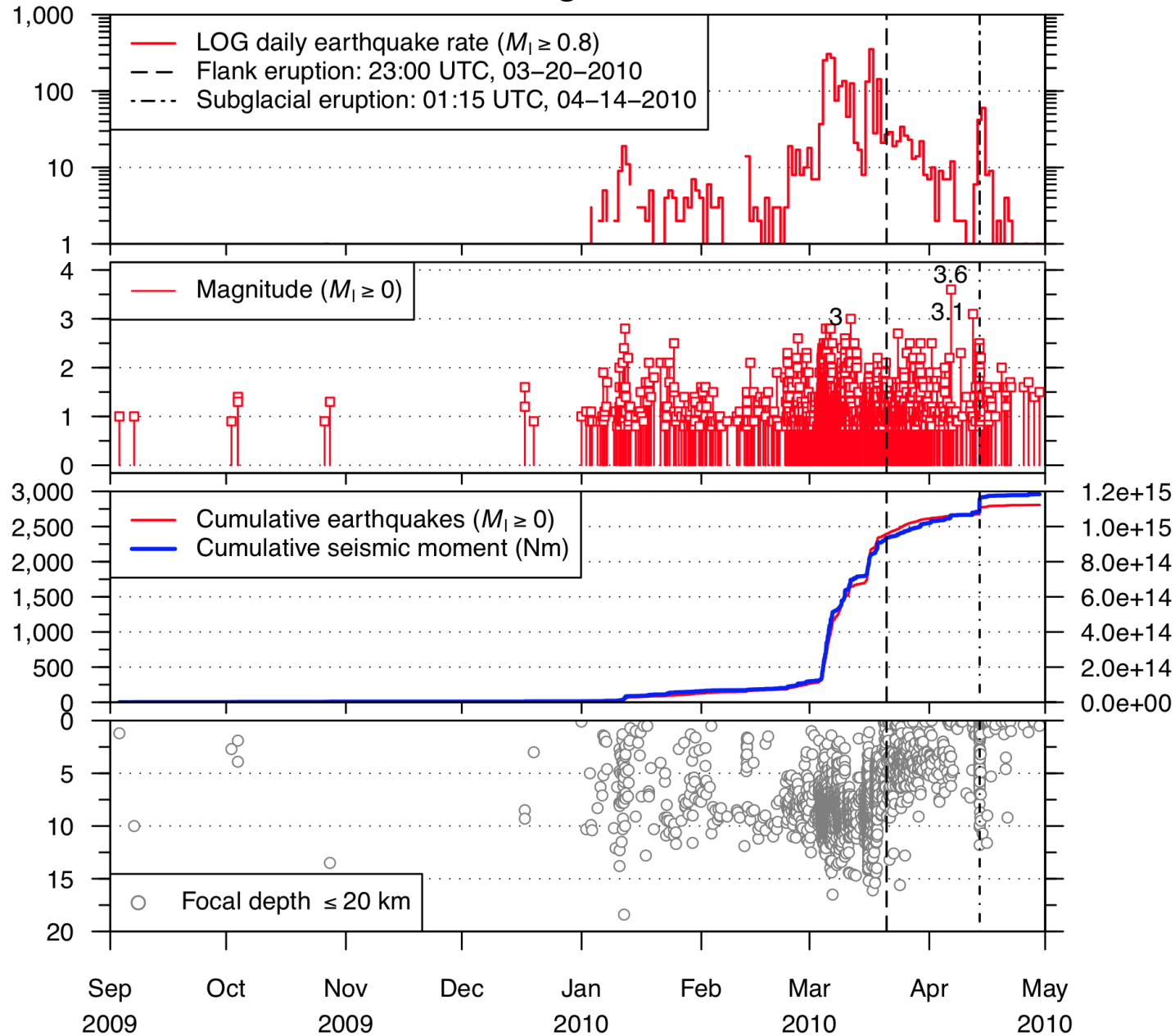
(photo: Eyjólfur Magnússon)



Schematic volcano model (USGS)

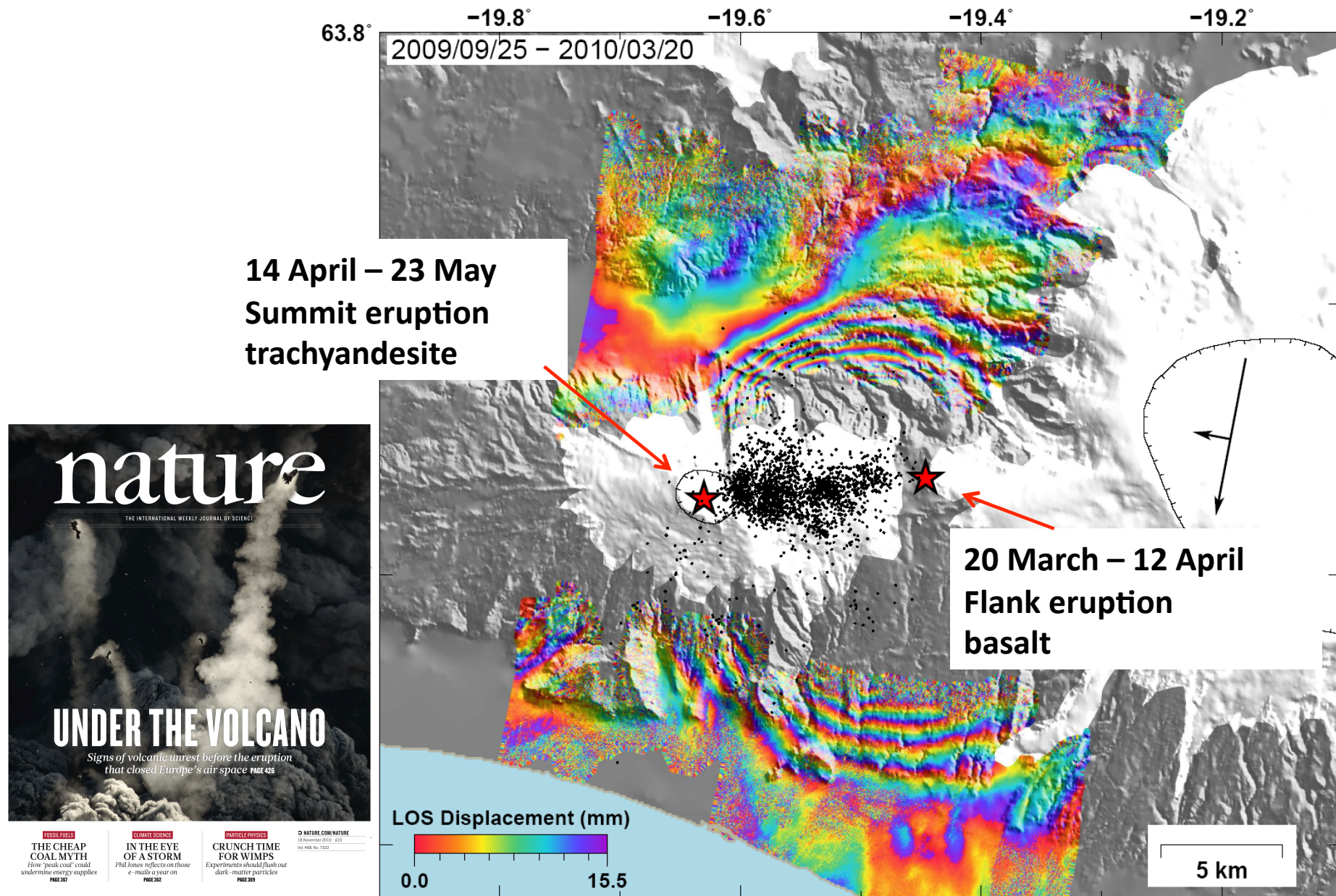


# Icelandic Meteorological Office seismic data



Sigmundsson, Hreinsdóttir, Hooper et al., Nature, 2010

# InSAR: Interferometric analysis of synthetic aperture radar images



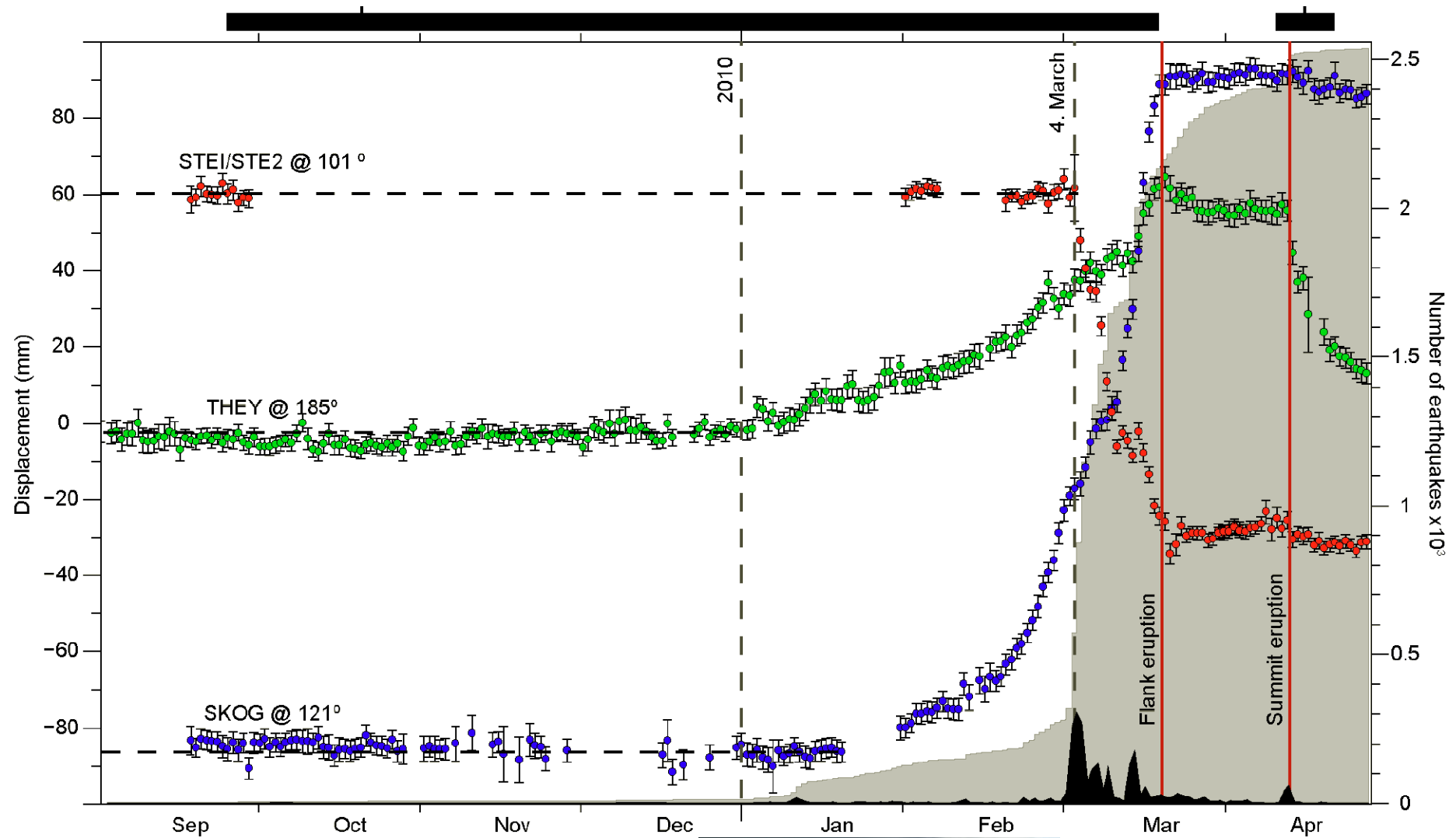
**FOSSIL FUELS**  
**THE CHEAP COAL MYTH**  
How 'peak coal' could undermine energy supplies  
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**CLIMATE SCIENCE**  
**IN THE EYE OF A STORM**  
Phil Jones reflects on those e-mails a year on  
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**PARTICLE PHYSICS**  
**CRUNCH TIME FOR WIMPS**  
Experiments should flush out dark-matter particles  
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**NATURE.COM/NATURE**  
18 November 2010 419  
ISSN 0950-9270

Sigmundsson, Hreinsdóttir, Hooper et al., Nature, 2010



Global Positioning  
System geodesy

Sigmundsson, Hreinsdóttir, Hooper et al.,  
Nature, 2010





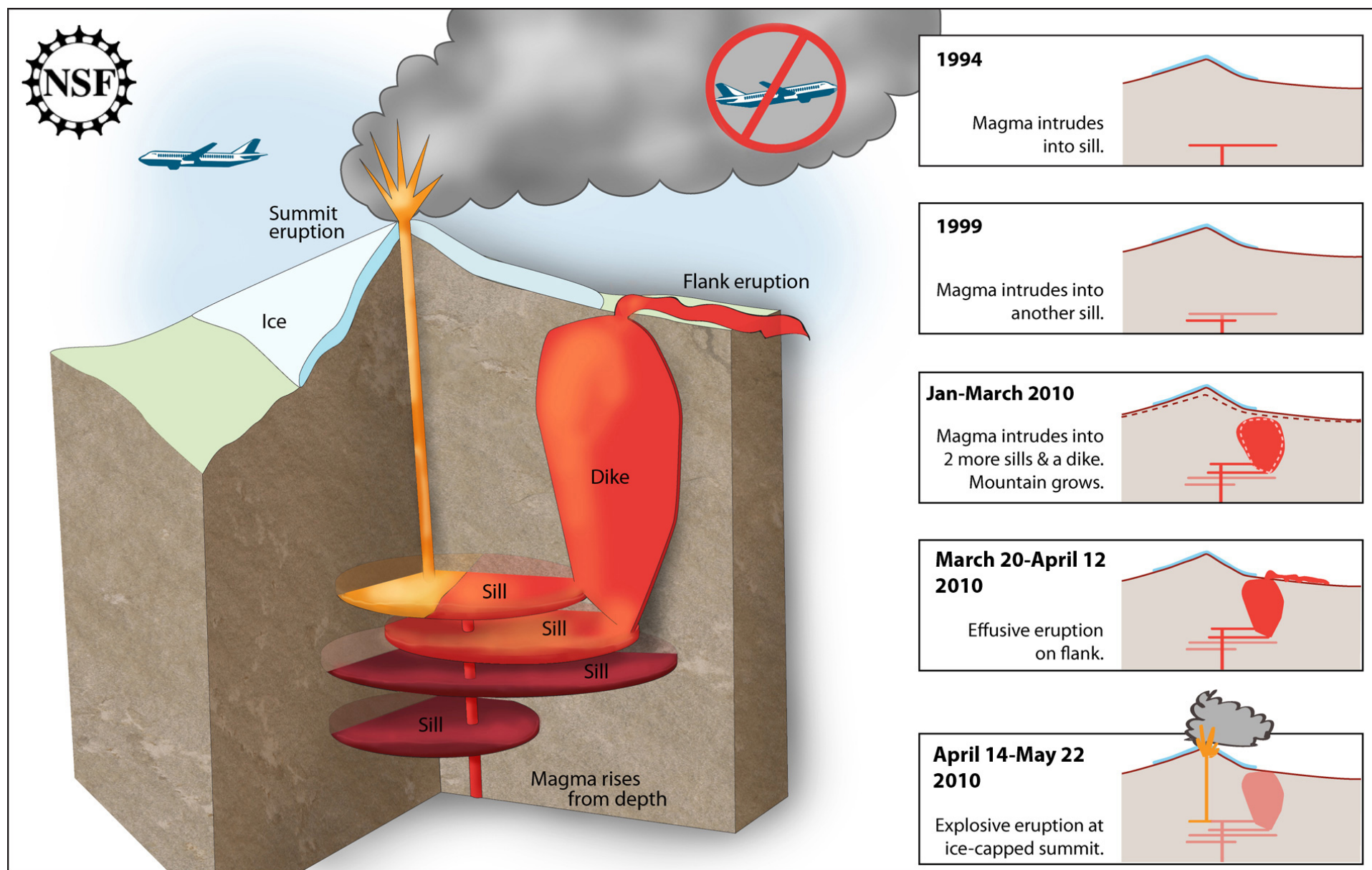
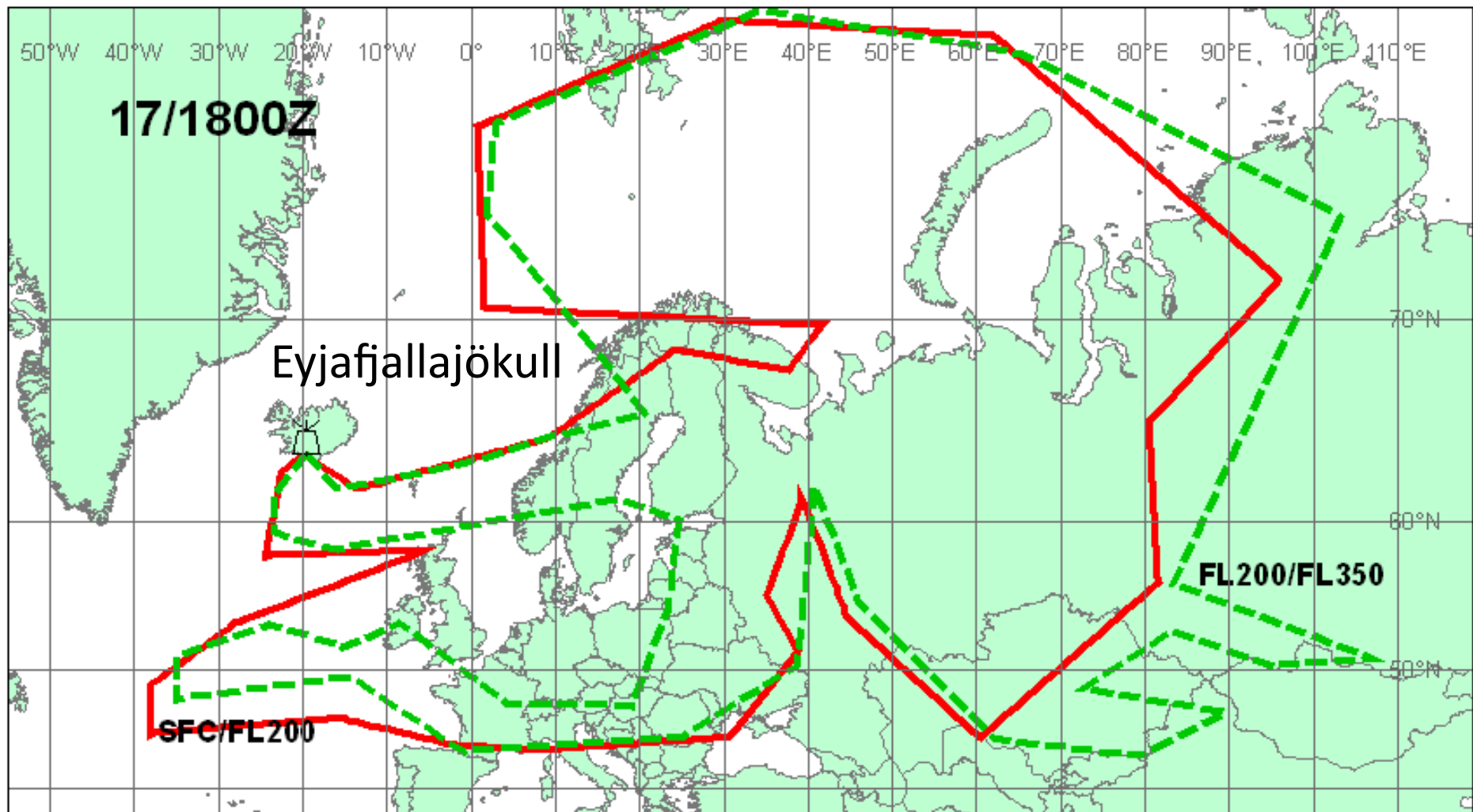


Figure: Zina Deretsky



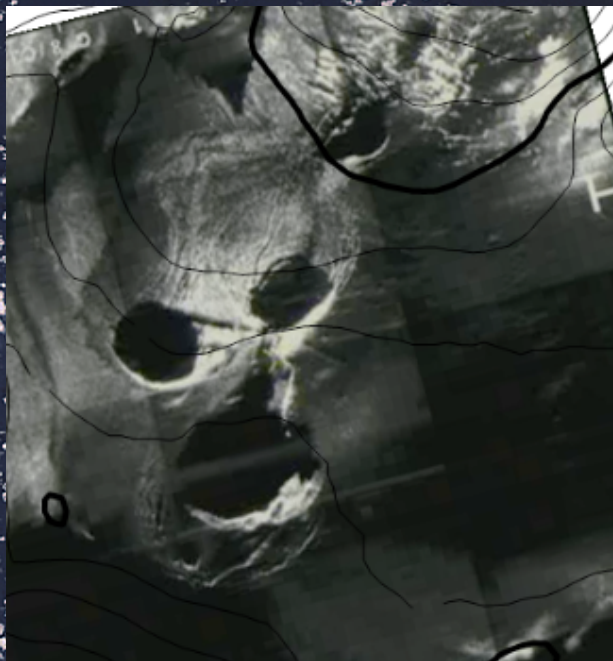
17 April 2010: Advice of the London VAAC - formed the basis for closure of large part of European air space 15-21 April 2010



**Eyjafjallajökull summit eruption 14 April – 22 May 2010**

Reykjavik

**Icelandic Coast Guard: Airborne SAR**

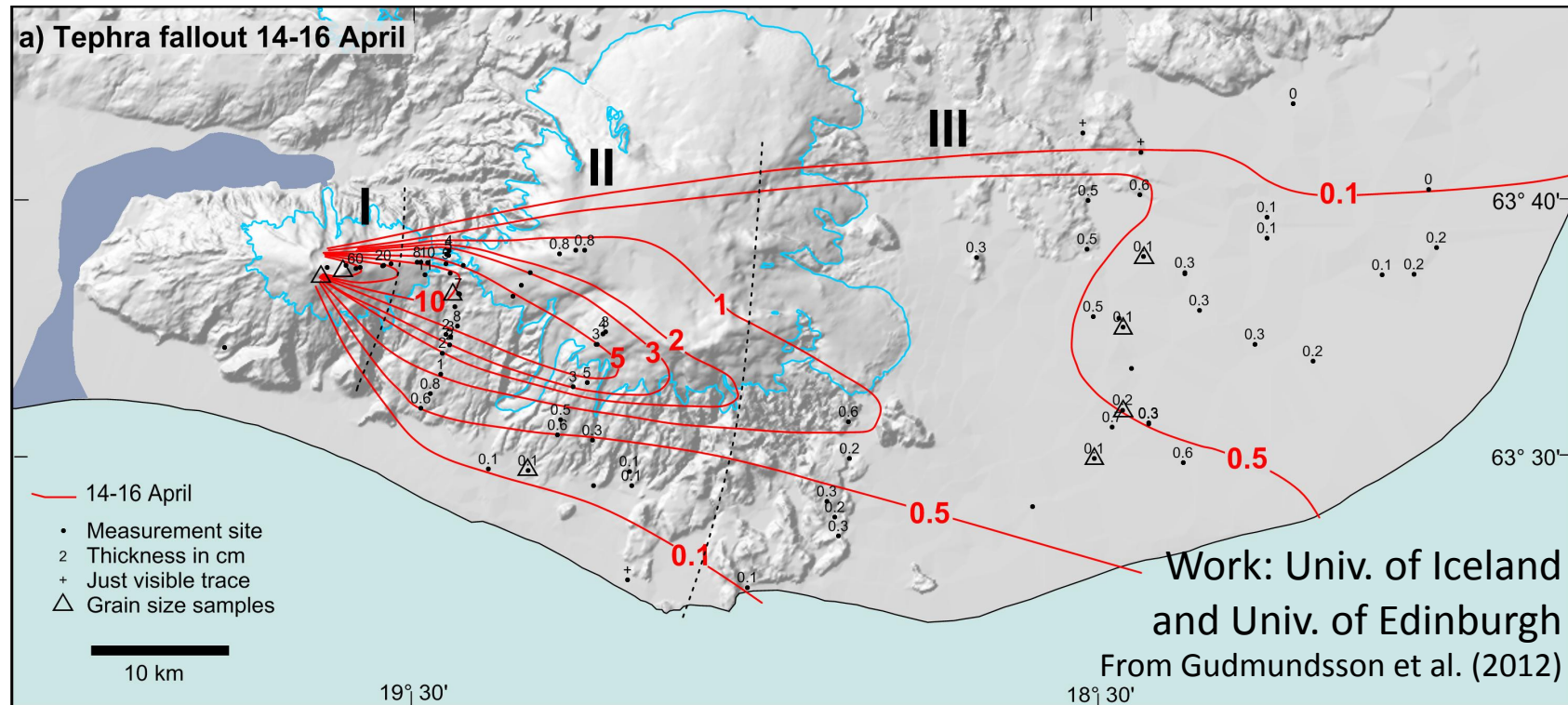


**ESA MERIS image - 17 April 2010**

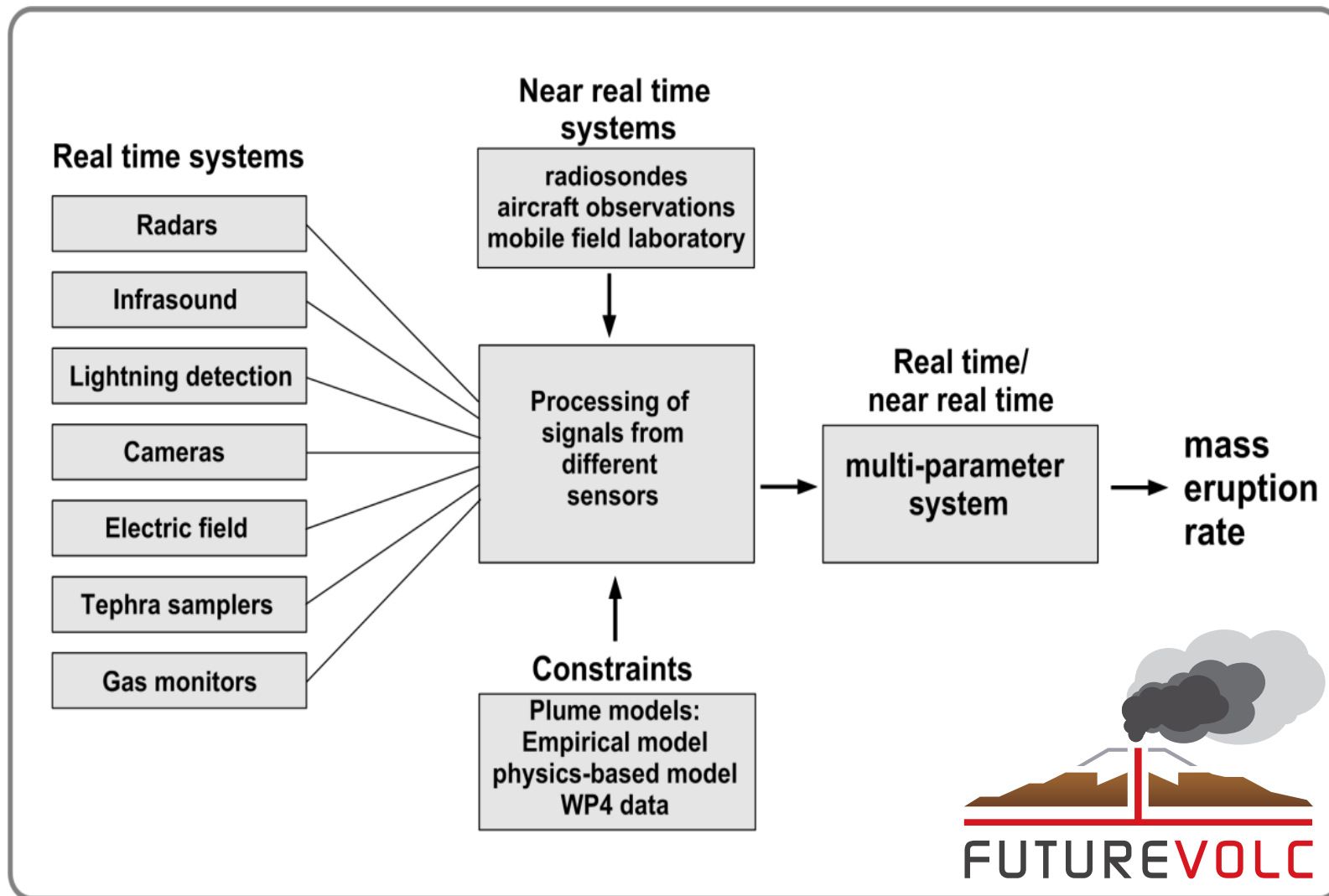


## Eyjafjallajökull 2010

- Mapping of ash fallout on land an essential part of quantifying explosive eruptions!
- Reliable estimates of quantity erupted come from the maps of fallout
- Eruptive products: dense rock equivalent volume  $0.18 \pm 0.05 \text{ km}^3$   
80% airborne tephra with bulk volume  $0.27 \text{ km}^3$



# Futurevolc: Multi-parameter system estimating mass eruption rate using data from all sensors





# Eyjafjalla- jökull

2010  
1821-23  
1612 or 1613  
~920

## Katla

1918  
1860  
**1823**  
1755  
1721  
1660  
1625  
**1612**  
1580  
~1500  
15th Cent.  
1440  
1416  
1357  
1262  
1245  
~1179  
~934  
**~920**  
~900

### Eruptions through ice

G. Larsen

Aster image

# The FUTUREVOLC approach

- Improve on observations and analysis as during the 2010 Eyjafjallajökull eruptions for future events (improving under-standing of precursors to volcanic activity, eruption mechanisms, eruption plumes and ash distribution, and appropriate responses)
- Combine researchers from different disciplines, working “below the surface, on the surface, and in the air”
- Combine monitoring and research
- Open data policy
- <http://www.futurevolc.hi.is>

